WHAT IS CLAIMED IS:

HIGH-SPEED ELECTRICAL ROUTER BACKPLANE WITH NOISE-ISOLATED POWER DISTRIBUTION

1. An electrical router backplane comprising:

multiple adjacent high-speed signaling layers, each high-speed signaling layer comprising a plurality of high-speed differential trace pairs between layers of a first dielectric material;

a first power distribution layer between layers of a second dielectric material, the first power distribution layer comprising a supply power distribution plane and a return power distribution plane separated by a layer of the second dielectric material; and

a plurality of ground planes, with at least one ground plane separating each two adjacent high-speed signaling layers, and with at least one ground plane separating the first power distribution layer from any adjacent signaling layers.

2. The router backplane of claim 1, wherein the first dielectric material has a substantially lower dielectric loss at high-speed signaling frequencies than the second dielectric material.

3. The router backplane of claim 2, wherein the second dielectric material has superior void-filling performance, as compared to the first dielectric material, under the same curing conditions.

4. The router backplane of claim 1, wherein the second dielectric material has superior void-filling performance, as compared to the first dielectric material, under the same

curing conditions.

5. The router backplane of claim 4, wherein both the first and second dielectric materials comprise resin-impregnated woven glass sheets prior to curing, the second dielectric material having a higher resin content than the first dielectric material.

6. The router backplane of claim 5, wherein both the first and second dielectric materials, prior to curing, comprise a thermosetting allylated polyphenylene ether.

7. The router backplane of claim 1, wherein the first dielectric material comprises a thermosetting allylated polyphenylene ether, and the second dielectric material comprises an FR4 glass sheet.

8. The router backplane of claim 1, further comprising a second power distribution layer similar to the first power distribution layer, the supply power distribution plane of the first power distribution layer adjacent to and facing the supply power distribution plane of the second power distribution layer, the two supply power distribution planes electrically isolated from each other within the backplane.

9. The router backplane of claim 8, the two return power distribution planes isolated from each other within the backplane.

10. The router backplane of claim 8, wherein each power distribution layer is an assembled and cured component prior to final assembly of the backplane.

11. The router backplane of claim 8, wherein the thickness of each supply and return power distribution plane is at least equivalent to the thickness of four-ounces-per-square-foot copper.

12. The router backplane of claim 8, further comprising a low-speed signaling layer comprising at least one trace plane between third and fourth layers of the second dielectric material, the low-speed signaling layer placed between the first power distribution layer and one of the pluralities of high-speed signaling layers, the low-speed signaling layer separated from the first power distribution layer by one ground plane layer and separated from the adjacent high-speed signaling layer by another ground plane layer.

13. The router backplane of claim 12, wherein the at least one trace plane shares a core dielectric layer of the second dielectric material with one of the ground plane layers on the opposite side of that core, that ground plane layer and one of the high-speed signaling layers sharing a b-stage dielectric layer, prior to final curing of the backplane, of the first dielectric material.

14. The router backplane of claim 8, each power distribution plane comprising a conductive guard ring adjacent the edges of the backplane and electrically direct-current isolated from the center conductive area of that power plane.

15. The router backplane of claim 14, having a chassis ground connection, wherein each conductive guard ring is connected to chassis ground.

16. The router backplane of claim 1, each power distribution plane comprising a conductive guard ring adjacent the edges of the backplane and electrically direct-current isolated from the center conductive area of that power plane.

17. The router backplane of claim 16, having a chassis ground connection, wherein each conductive guard ring is connected to chassis ground.

18. The router of claim 17, having a digital ground connection, wherein each ground plane is connected to digital ground.

19. The router backplane of claim 1, wherein the plurality of ground planes connect to each other throughout the planar area of the planes, the connection comprising a large plurality of plated thru-holes.

20. The router backplane of claim 1, wherein the thickness of the supply and power distribution planes is at least equivalent to the thickness of four-ounces-per-square-foot copper.

21. The router backplane of claim 1, wherein the power distribution layer is located depth-wise at approximately the center of the backplane, with high-speed signaling layers both above and below the power distribution layer.

22. An electrical router backplane comprising:

first and second pluralities of adjacent high-speed signaling layers, each high-speed signaling layer comprising a plurality of high-speed differential trace pairs

between layers of a dielectric material;

first and second low-speed signaling layers inwardly adjacent, depth-wise, the first and second pluralities of high-speed signaling layers, each low-speed signaling layer between layers of a dielectric material;

a first power distribution layer between layers of a dielectric material, the first power distribution layer comprising a supply power distribution plane and a return power distribution plane separated by a layer of dielectric material, the first power distribution layer inwardly adjacent, depthwise, the first and second low-speed signaling layers; and

a plurality of ground planes electrically connected to each other by a large distributed plurality of plated thru-holes, with at least one ground plane separating

each two adjacent high-speed signaling layers,

each plurality of high-speed signaling layers from the adjacent low-speed signaling layer, and

each low-speed signaling layer from the first power distribution layer.

23. The router backplane of claim 22, further comprising a second power distribution layer similar to the first power distribution layer, the supply power distribution plane of the first power distribution layer adjacent to and facing the supply power distribution plane of the second power distribution layer, the two supply power distribution planes electrically isolated from each other within the backplane.

24. The router backplane of claim 22, wherein the dielectric material for the high-speed signaling layers is of a first material type and the dielectric material for the low-speed signaling layers and the power distribution layer is of a second material type having a

higher dielectric loss at high-speed signaling frequencies.

25. The router backplane of claim 22, wherein the first and second low-speed signaling layers each comprise multiple signaling planes separated by a dielectric material.

26. An electrical router backplane comprising:

first and second pluralities of adjacent high-speed signaling layers, each high-speed signaling layer comprising a plurality of high-speed differential trace pairs between layers of a dielectric material, such that the number of high-speed differential trace pairs, in aggregate, is at least 500 pairs;

first and second low-speed signaling layers inwardly adjacent, depth-wise, the first and second pluralities of high-speed signaling layers, each low-speed signaling layer between layers of a dielectric material;

first and second power distribution layers between layers of a dielectric material, each power distribution layer comprising a supply power distribution plane and a return power distribution plane separated by a layer of dielectric material, the supply and return power distribution planes each having a thickness at least equivalent to the thickness of three-ounces-per-square-foot copper, the first and second power distribution layers inwardly adjacent, depthwise, the first and second low-speed signaling layers; and

a plurality of ground planes electrically connected to each other by a large distributed plurality of plated thru-holes, with at least one ground plane separating

each two adjacent high-speed signaling layers,

each plurality of high-speed signaling layers from the adjacent low-speed signaling layer, and

each low-speed signaling layer from the first power distribution layer.

27. The router backplane of claim 26, wherein the power distribution planes of the first and second power distribution layers face each other and are separated only by dielectric material.

28. The router backplane of claim 27, having a chassis ground connection, each power distribution plane comprising a conductive guard ring adjacent the edges of the backplane and electrically direct-current isolated from the center conductive area of that power plane, each conductive guard ring connected to chassis ground.

29. The router backplane of claim 27, having a digital ground connection, wherein each ground plane is connected to digital ground.